B12 Comparison of the Volatile Biomarkers From Biological Specimens for Profiling Potential

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After attending this presentation, attendees will understand the difference between the volatile organic compounds present in different biological samples as well as how to evaluate the profiling potential of volatile biomarkers in blood, breath, buccal cells, sweat, and urine for metabolic profiling.

This presentation will impact the forensic community and/or humanity by demonstrating how the analysis of VOCs in biological fluids can reveal interesting diagnostic properties of different biomarkers, differentiating populations (i.e., healthy vs. illness) as well as how biological evidence collected may be useful for human identification in terms of matching individuals to odor from a crime scene. Volatile organic components of human scent play important roles in scent association between a person and evidence. Human scent identification line-ups are possible as each person has distinctive odors.

The purpose of this poster is to provide the forensic community with a comparison between the volatile organic compounds present in different biological samples. The goal of this research is to evaluate the profiling potential of volatile biomarkers in blood, breath, buccal cells, sweat, and urine for metabolic profiling.

The human odor is made up of a variety of organic compounds such as aldehydes, alcohols, alkanes, esters, fatty acids, and ketones. Volatile organic compound (VOC) analysis in biological samples such as expired air (breath), sweat, blood, and urine has been used for various applications such as toxicology, medicine, and forensics. Over the recent years interest has increased regarding the identification of VOCs for metabolic profiling or diagnostic potentials for certain diseases that are known for its association with distinct odor.

Identification of target odor compounds can provide valuable information to both the medical and forensic communities. From the medical perspective, analysis of VOCs in biological fluids can reveal interesting diagnostic properties of different biomarkers. In addition to the disease diagnostic potential, analysis of VOCs in biological samples may be useful in differentiating populations (i.e., healthy vs. illness). From the forensic perspective, biological evidence collected may be useful for human identification in terms of matching individuals to odor from a crime scene. Volatile organic components of human scent play important roles in scent association between a person and evidence. Human scent identification line-ups are possible as each person has distinctive odors. Canines have the ability to discriminate human scent because people smell different.

Because odor signatures are unique, human scent evidence provides an invaluable means of aiding in the identification of possible suspects. Law enforcement agencies have utilized visual line-ups to identify suspects for decades. However, visual line-ups may be impractical at times when individuals alter their appearance. It is also true that eye- witness testimony has come under increasing scrutiny over the past years because of its unreliability. Scent evidence remains constant, and whereas physical evidence such as blood and hair can be removed from the crime scenes, scent evidence may linger for a longer period of time.

Curran et al. have detected and identified the VOCs present in human odor from sweat samples using solid phase micro-extraction gas chromatography mass spectrometry (SPME-GC/MS). They have shown that human scent is a combination of various compounds differing in ratio from person to person as well as other compounds that varied among individuals. These differences in compounds and ratios have not yet been extended to different biological specimens beyond sweat and hand odor.

There is currently no direct comparison made between the volatile organic compounds present in different biological samples (blood, breath, buccal cells, sweat, and urine). Therefore the question of matching VOCs present in human scent compounds across various biological samples still remains unanswered. In this study SPME- GC/MS was utilized to extract, separate, and identify the volatile components from the collected biological samples. The purpose of this research is to evaluate the potential of headspace SPME-GC/MS for profiling VOCs from different biological samples.

Collections of biological specimens were optimized. Hand odor samples were collected on a pre-treated 2 x 2 sterile gauze pad. Expired air was sampled in a Teflon breath sampling apparatus. Whole blood was obtained by finger stick sampling and collected into capillary tubes. Urine and buccal cell specimens were collected under typical forensic evidence collection methods, which were immediately transferred into 10 mL headspace vials. It has been shown that the abundances of the VOCs from hand odor samples can be used to differentiate individuals. Other biological specimens show some common VOCs but also significant differences. The differences observed for the VOCs from different individuals and different population sets has potential for use in characterizing the individual, but additional samplings and a larger population study is needed to make conclusions regarding this potential.

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